hourly eye readings. The report for 1901, which is the last to be received, gives the data in full, including records of evaporation, earth temperatures up to a depth of 1.15 meters, earthquakes as registered by the Milne seismograph, and solar radiation. This last element, whose determination is facilitated by the comparatively cloudless skies of Egypt, is measured by a Callendar sunshine receiver, which in November, 1901, replaced the ordinary bright and black bulb thermometers in use up to that time.

Observations at the Abbassia Observatory, 1901.

Months.	Temperature, in degrees C.					Relative humidity.			Mean cloudiness, tenths.	Wind.		
										Velocity in miles per hour.		Prevailing direction.
	Mean.	Max.	Min.	Mean max.	Mean min.	8 a.m.	8 p.m.	Min.		Mean.	Max.	
January.....	12.1	20.5	0.4	17.1	5.8	75	60	25	3.8	4.6	34	sw.
February ...	15.5	30.2	3.2	22.8	7.8	82	65	10	3.6	2.9	21	nne.
March.......	19.0	40.4	6.0	27.0	10.5	70	51	4	2.1	4.7	23	nw.
April........	21.1	39.4	8.4	28.7	13.0	69	50	6	3.0	4.4	20	n.
May..........	24.1	43.0	11.2	31.7	15.5	54	39	7	3.1	5.4	21	ne.
June	27.9	42.2	15.4	35.9	19.4	58	43	3	1.8	4.2	18	n.
July	28.7	41.0	19.0	36.5	20.2	70	42	13	1.5	2.9	15	nw.
August......	27.8	40.0	17.4	34.3	20.0	74	52	21	1.6	2.7	16	nw.
September...	25.5	38.0	16.2	32.5	18.7	75	61	19	1.2	2.6	14	nw.
October	23.2	33.0	13.5	29.4	17.0	80	65	23	2.3	4.3	22	n.
November...	18.9	33.6	8.7	24.5	12.5	74	62	15	3.2	2.6	19	s.
December ...	14.8	27.6	5.2	21.1	8.8	81	68	20	3.8	2.9	24	s.
Year	21.6	43.0	10.4	......	......	72	55	3	......	3.7	......	n.

The precipitation for the year amounted to 35.90 millimeters (1.41 inches) and fell on ten different days. There were six months in which no rain fell. During the 15-year period, 1884–1898, the highest temperature was 45.2° C. (113.4° F.), and the lowest —0.7° C. (30.7° F.). The report also contains observations from 12 second order stations, mean values at Wadi Halfa for the decennium ending in 1900, and gage readings from several stations on the Nile.

The Abbassia Observatory was about three miles from Cairo, with the open desert on one side and the highly cultivated Delta of the Nile on the other. The removal to Helwan was made partly for the sake of obtaining a purely desert exposure and partly to establish a magnetic observatory free from the influence of trolley lines and railroads.—*F. O. S.*

THE HEURISTIC METHOD.

In the article by Prof. J. M. Pernter, a translation of which is published in the MONTHLY WEATHER REVIEW for December, 1903, the author speaks of the heuristic method of discovering a correct method of forecasting. Wherever this word occurred we have translated it variously; namely, as the "discovery method," and again as the "inventive method." From the context, one may easily perceive that "heuristische" refers to that method in accordance with which one invents or devises a method or basis of forecasting, and then endeavors to find agreements between the predictions and the weather that will confirm the forecasts and thus establish the correctness of the principles on which these are based. The word heuristic has generally been used in English to indicate any method by which one discovers unknown laws, but in lieu of any better special word Pernter has adopted this particular application to a method that must be distinguished from the inductive or the deductive.

In the strict, logical, inductive method we first observe many phenomena, such as daily temperatures, pressures, and winds, and from these facts, by various processes of study, we are led to generalizations and hitherto unknown laws, such as the geographic distribution of the diurnal amplitude, the moment of maximum, etc.

In the strictly deductive method, we begin by accepting certain principles or laws, such as the law of inertia or the law of gravitation, or the laws of the conduction of heat; by reasoning upon these by strictly logical or mathematical methods we arrive at their necessary consequences, and thus learn to recognize and accept new laws or hitherto unknown phenomena.

All our progress in science must depend upon the proper application of these three methods of reasoning. Observation and experiment, maps and tables of figures are not the laws of nature, but result from those laws, and we can not pass from this crude data back to the general laws except by adhering to the most rigid logic. Mathematics and even the doctrine of chance are but forms of logic. We are all familiar with the legitimate syllogism, "All B is A; C is B: therefore, C is A." But how many are apt to be misled by the following syllogism: All B is A; C is A: therefore, C is B.—*C. A.*

THE GALVESTON HURRICANE AND OCEAN WAVE.

Mr. Adolphus Carper, Galveston, Tex., writes to the Chief of the Bureau that he is confirmed in his previous statement that the destructive high water at Galveston on September 8, 1902, must have been due to a combination of wind or hurricane wave, and tidal or oceanic wave. He says this view is not generally accepted in Galveston, but is confirmed by the fact that—

the hurricane came upon the city from the north, having traversed Texas, the ravages of which commenced in Bell County, 218 miles north of Galveston. The tidal wave came from the southwest, from the Gulf, sweeping over Galveston in the face of a hurricane calculated to have had a velocity of 120 miles per hour. It, the tidal wave, vanished as quickly as it came; the gale, still blowing, leaving behind a black ooze of a sickening, disgusting odor. About the end of September a sailing craft arrived in New York Harbor whose captain, in his sworn protest at the custom-house, reported having passed a locality in the Bay of Campeachy about the date of the Galveston disaster showing by its vast disturbed area that a submarine volcanic eruption must have taken place in that spot.

ARE THE MOVEMENTS OF THUNDERSTORMS DEFLECTED BY THE TIDE?

A letter from Dr. J. Russell Smith, of the University of Pennsylvania, states that unscientific observers believe that the thunderstorms passing near Cape May are deflected up or down the Delaware Bay by the tides, and asks if this is correct, and what is the explanation?

As this was a new idea in meteorology, a letter of inquiry was sent to our station agent at Cape May, Mr. George L. Lovett, who replied, inclosing a diagram showing the paths of storm movements across Delaware Bay, and stating that they are deflected by the tides and not by the winds. According to his diagram, an incoming flood tide generally enters the bay from the southeast and carries thunderstorms northward; an outflowing ebb tide, moving southward, carries thunderstorms southward; during slack water, storms move eastward straight across, irrespective of wind direction and velocity.

The Editor judges that possibly Mr. Lovett's letter expresses a general belief on the part of the inhabitants of Cape May and the adjoining country, but as there is no a priori reason to believe that tides can have any such influence, it seems important that the dates and observations should be put on record. In order to establish such a novel rule, it will not do to pick out a few favorable coincidences, but it is necessary to carefully plot the path of every thunderstorm for a year or more, and then correlate these paths with the tides and winds. Moreover, the temperature of the surface water must be observed, since it is quite plausible that, with an incoming tide and a southerly wind, the surface water on the east side of the bay would have a different temperature from that on the west side, so that the relative evaporation and moisture of the air may influence the development and path of a thunderstorm. The principal difficulty is the correct plotting of the paths of the storms. This can only be done by the cooperation of many observers. In fact, one ought to organize a special thunderstorm service for Delaware Bay and southern New Jersey. It is quite impossible for one person, by observations at one station, to determine anything more than the apparent limit of that edge of the storm that is visible to him. The other edge and the center of the storm are usually hidden.

As it is impossible to establish thunderstorm stations on Delaware Bay itself, it may be that it will always be impossible to determine the path of the storm over the bay with sufficient accuracy to establish the truth of Mr. Lovett's theory as to the action of the tides. We hope that he will not fail to secure the cooperation of voluntary thunderstorm observers, and report to the readers of the MONTHLY WEATHER REVIEW the actual paths of the centers of thunderstorms, as well as the advancing fronts of the storms.—*C. A.*

THE DIURNAL VARIATION OF THE BAROMETER AT MILWAUKEE.

In 1868 Maj. R. S. Williamson published his memoir on the use of the barometer in surveys, as Professional Paper No. 15, of the Corps of Engineers, U. S. Army. Among other things he attemped to derive true mean daily pressures by eliminating the diurnal periodicity, and maintained that a close approximation to the diurnal variations could be obtained from a few days' work by a special process of eliminating the slower variations by virtue of which the pressure rises and falls rather regularly for several days at a time, owing to the passage over the country of the so-called areas of high pressure and low pressure. In Williamson's method a straight line is drawn connecting two points on the barometric curve that are twenty-four hours apart, as, for instance, 7 a. m. and 7 a. m. This line, therefore, represents the slower variation; the departures of the curve from this straight line represent approximately the effect of the semidiurnal periodicity.

We have lately received from Miss Mary Lapham, of Oconomowoc, Wis., a manuscript left by her father, the late Prof. I. A. Lapham (apparently written in 1870), in which he gives his hourly barometric readings for one day in each month and the result of treating them by Williamson's method. The manuscript is not entirely in shape for publication, but the following extracts will serve to present the more important features and show the author's train of thought.—*C. A.*

THE ATMOSPHERIC TIDE AT MILWAUKEE, WIS.

By the late I. A. LAPHAM.

Atmospheric tides are caused or modified by several influences :

1. The attraction of the moon varying with its declination and distance, and its position with regard to the sun.
2. The attraction of the sun.
3. The earth's orbital motion.
4. The earth's diurnal rotation.
5. Changes of atmospheric temperature.
6. Changes in the amount of atmospheric moisture.

In order to ascertain whether the hourly oscillations of the barometer, indicating a tidal wave in the atmosphere, could, as suggested by Maj. R. S. Williamson, be determined by a single day's observations, I made such observations at Milwaukee, commencing at 7 a. m., October 19, 1868. The moon reached the meridian three hours after the sun—had 18° south declination—the sun's declination 10° south. The abnormal oscillation was manifested by a pretty uniform rise of the barometer during nearly the whole day. The temperature did not vary much during the twenty-four hours, being at 7 a. m., 41°; at 2 p. m., 45°; at its maximum, 49°; at 9 p. m., 43°; and at its minimum depression during the night, 41°. But little of the atmospheric tide can, therefore, be attributed to the change of temperature between the day and night. The sky continued to be uniformly cloudy, wind moderate, the air contained from 61 to 77 per cent of the amount of aqueous vapor it was capable of holding; the pressure of vapor was equivalent to from 0.181 to 0.198 inches of mercury. So the wave could not have been much affected by changes in the hygrometrical condition of the atmosphere.

Hence, these observations were favorable for showing the effect of astronomical causes upon the atmosphere.

The observations for November 14-15, 1868, were taken under circumstances equally favorable with those of October for avoiding the effect of great changes of temperature and moisture. They show a much more prominent morning maximum, which may be owing to the nearness of the sun and moon. The evening maximum is scarcely discernible. The same nodes are observed upon comparison with observations at Thunder Bay and Toronto, but at a different time, being about noon and midnight. The great depression between 2 p. m. and 10 p. m. must be owing to some uneliminated, abnormal, fluctuation.

The remainder of the manuscript is summed up in Tables 1 and 2, compiled in March.

In 1869, Professor Lapham sums up the results of his observations "taken hourly one day in each month at the time of the new moon," and concludes, "Thus it appears that when the latitude of the moon is north, the atmospheric tide is considerably less than when it is south."

Apparently Professor Lapham returned to this subject in 1870, as we find among his papers a few additional sheets, giving hourly readings for six days, June 28–July 4. But in this latter series very few actual observations were taken between 10 p. m. and 6 a. m., inclusive, so that he filled in this portion of the record by simple interpolation. The figures given by Professor Lapham for these days are reproduced in Tables 3 and 4, to which we have added a column of means. The hourly corrections in Table 4 are deduced from the actual observations of Table 3 by assuming, with Williamson, that the total change in pressure from 7 a. m. to the next following 7 a. m. has gone on at a uniform rate. After applying to each hourly observation its proportional part of this daily change, the observations are said to have been reduced "to level." The average of the 24 observations, as thus reduced, gives the mean pressure for the day, and the difference between this mean and the individual observations corrected to level gives the departure due to diurnal tide, or the diurnal periodic variation of pressure freed from the irregular variations due to highs and lows.

Of course, the few days of hourly observations secured by Professor Lapham during these years can not give us a satisfactory determination of the diurnal period, but they afford a very good illustration of an effort to carry out the suggestions made by Major Williamson. During these same years, 1868–70, and subsequently, the officers of the battalion of engineers stationed at Willetts Point, New York Harbor, maintained a series of hourly observations and published the results in successive general orders issued at that post. A similar record was kept at Jefferson Barracks, Mo., and occasionally there was printed a comparison between the horary curves at Jefferson Barracks, Willetts Point, and the Dudley Observatory, Albany, where Prof. G. W. Hough kept his self-registering and printing barometer in activity. This publication is now very rare, only one copy being on file in the office of the Chief of Engineers, United States Army.

In general, however, it should be stated that this method of determining the diurnal period of pressure, or temperature, has not been widely adopted by meteorologists, and the exhaustive studies on this subject by Professor Hann have been based upon the older and less laborious methods of procedure.

Figures in italic are interpolated values.—*C. A.*